
Summaries

UDC 621.81:620.169.1+001.891

Sarkisov Yu.S., Ametov V.A., Kurzina I.A., Vlasov Yu.A.
**RESOURCE SAVING TECHNOLOGIES OF INCREASING
QUALITY AND DURABILITY OF ELEMENTS, NODES AND
MECHANISMS AT NANO-, MESO- AND MACROLEVELS**

The approaches to development of new materials and processes for increasing durability of transport vehicle elements based on methodology of nonequilibrium material science have been considered. The developed approach allows controlling the behavior of tribological systems «aggregate-oil» at micro-, meso- and macrolevels of organizing boundary layers.

UDC 621.01

Dvornikov L.T., Dmitriev V.V.
**THE PROBLEM OF REDUNDANT JOINTS IN PLANETARY
GEAR TRAINS AND ITS SOLUTION**

The occurrence of redundant joints in multi-satellite planetary gear trains formed of four-level planetary gear train with one satellite by adding supplementary satellites has been considered. Each additional satellite decreases mobility of initial mechanism by a unit transforming it into statically undeterminable system, i.e. into mechanisms with redundant joints. In order to solve the problem it is proposed to add to the initial mechanism not separate satellites but groups with zero mobility; one or several links represent supplementary satellites.

UDC 531.391:518.5

Bituev I.K., Pavlov B.I.
SIMULATION OF GANG ROTATING UNITS

The dynamic model of the gang has been considered by the example of drive of the machine tool spindle carrier rotation. Spur and worm gears, maltese mechanism and planetary link motion state are applied for transferring motion and stresses in the drive.

Nonlinear dependence of dynamic characteristics of maltese mechanism on crank angle was considered and taken into account. The engine power required for rotating the of maltese mechanism driven link – spindle carrier is calculated. The power from spindle motion character was estimated. The references on decreasing the required efforts are given.

UDC 621.869

Minin V.V.
**SIMULATION OF SKID-STEER
LOADER OPERATION FACTORS**

The equations defining the main parameters of skid-steer loaders with a side turn have been obtained on the basis of posteriori information. For calculations of productivity of machines with different operating mass the most probable values of carrying capacity, engine power and cycle time were obtained. The efficiency was estimated.

UDC 621.787

Skvortsov V.F., Okhotin I.S., Arlyapov A.Yu.
**RESIDUAL STRESSES AT PIN HOLE MANDRELLING
IN HOLLOW THICK-WALLED CYLINDER WITH
AT GREAT TENSIONS**

The technique and the results of the experimental researches of the residual stresses at pin hole mandrelling in the hollow thick-walled cylinders have been introduced. It was stated that at great tensions the considerable hoop, radial and axial residual stresses are formed in steel cylinders and they increase at growth of the degree of cylinder wall thickness and a number of mandrelling cycles.

UDC 621.744.4

Glazov A.N.
**INFLUENCE OF OPERATIONAL FACTORS
ON CHARACTERISTICS SHAKING MOLDING MACHINE**

The results of investigations in working environment the influence of compressed air and load pressure on operation of the shaking molding machine with stroke complete depreciation have been introduced. The dependence of air consumption on its pressure and temperature are given. The measuring-controlling device is described.

UDC 669.112.227.342+539.4.015+620.172.242+620.179.17

Apasov A.M.
**THE ANALYSIS OF ACOUSTIC EMISSION SIGNALS
PARAMETERS AT HIGH-TENSION STEEL DESTRUCTION**

The acoustic emission signals at testing for uniaxial tension of the basic metal flat models as well as the samples with welded faultless joint in transverse direction and with technological defects: poor weld fusions, undercuts, pores, longitudinal and cross cracks have been studied. It was stated that total acoustic emission should be used as the principle parameter. The total value of amplitudes and sum of single pulses should be taken as the additional information. The obtained data indicate the possibility of applying the acoustic emission method for recording signals from sources of forming and developing defects at standard tests of high-tension steel items.

UDC 621.892.004.6

**Kovalskiy B.I., Bezborodov Yu.N.,
Kovalskiy S.B., Malysheva N.N., Maltseva E.G.**
**THE TECHNIQUE OF STUDYING THE ANTIWEAR PROPERTIES
OF COMMERCIAL MOTOR OILS AND MECHANO-CHEMICAL
PROCESSES AT BOUNDARY SLIDING FRICTION**

The technique of testing lubricants for antiwear properties subject to the mechano-chemical processes occurring at frictional contact at boundary sliding friction estimated by electrochemical method has been introduced.

UDC 621.892.1

Kovalskiy B.I., Kovalskiy S.B., Berko A.V., Malysheva N.N.
**THE RESULTS OF TESTING MINERAL MOTOR
OIL FOR TEMPERATURE STABILITY**

The influence of temperature destruction products on antiwear properties of mineral motor oil M10-ГК on temperature stability and parameters of destruction product influence on antiwear properties and durability of steel ShKh15 have been determined.

UDC 577.3.01;577.38

Borisov A.V., Trifonov A.Yu., Shapovalov A.V.
**FORMATION OF DISSIPATIVE STRUCTURE
IN TWO-DIMENSIONAL POPULATION DYNAMICS
WITH NONLOCAL INTERACTION**

The influence of nonlocal interaction on population dynamics in two-dimensional reaction-diffusion model has been studied by numerical methods. The dynamic equation of the model generalizes the known equation of Fisher-Kolmogorov-Petrovsky-Piskunov and takes into account the nonlocal interaction of samples in population of various types including taxis. The two-dimensional dissipative structure formed by so-called taxis rings was obtained at a certain choice of the model parameters. The properties of the obtained structure are discussed.

UDC 517.9;577.3.01;577.38

Borisov A.V., Trifonov A.Yu., Shapovalov A.V.
TWO-DIMENSIONAL DYNAMICS OF DISTRIBUTIONS
WITH ONE AND TWO CENTERS IN NONLOCAL
REACTION-DIFFUSION MODEL

Two-dimensional dynamics of population with one and two inoculation centers has been numerically compared within the frames of the reaction-diffusion model with nonlocal interactions generalizing the known population model of Fisher-Kolmogorov-Petrovsky-Piskunov. The nonlocal interaction in population is described by integral operator with a nucleus in the form of Gaussian function.

UDC 539.1

Myagkiy A.N.
ASYMPTOTIC SOLUTION OF SCHRÖDINGER EQUATION
IN NONCOMMUTATIVE QUANTUM MECHANICS

Asymptotic solutions of Schrödinger equation for a charged non-relativistic particle with spin 1/2 in the external electromagnetic field in noncommutative space have been constructed. Classical motion equations of charge and particle spin in a first approximation by the parameter of noncommunicativeness were obtained.

UDC 535.2:621.373.826

Lukin I.P.
BESSEL BEAM FLUCTUATIONS IN RANDOM MEDIUM

Fluctuations of the level (amplitude logarithm) and phase of fundamental Bessel optical beam propagating in turbulent atmosphere have been studied by the method of smooth perturbations. The fractional attenuation effect of fluctuation of the level (amplitude logarithm) of fundamental Bessel beam in comparison with similar characteristic of a plane optical wave was revealed. It was shown that fluctuations of the level (amplitude logarithm) of such beam are considerably inhomogeneous in cross section of the beam. Spatial correlation fluctuation function of the level (amplitude logarithm) and spatial structural fluctuation function of the phase of fundamental Bessel beam within its first maximum are weakly sensitive to the changes of the main parameter of this beam – the components of wave vector orthogonal to the direction of optical radiation propagation.

UDC 621.039.51

Shamanin I.V., Kiselev A.V., Lyzko V.A.
CONTROL OF POWER DENSITY FIELD AT NUCLEAR
REACTOR OPERATION BY LINEAR CHARGE DETECTORS

The results characterizing numerically the influence of current formed in detector emitter on a transfer function value to the average power of fuel elements, such parameters as the fuel burn-up fraction in fuel assemblies, coolant density which is a moderator at the same time, and boric acid concentration in the coolant were obtained. The results show the changes of representativity (quality) of information on power density distribution in active zone which is obtained at processing of analogue signal (current) with a linear charge detector by the system of intrareactor control. Besides, the results indicating the significant influence of spectral characteristics of neutron field on the linear charge detector indices and reflecting spectral characteristic sensitivity to operation conditions and the nuclear reactor state were obtained in the work.

UDC 621.039.5

Bedenko S.V., Zolotovskiy A.V., Lyzko V.A.,
Nesterov V.N., Shamanin I.V.
ESTIMATION OF THE EFFECTIVE VALUE
OF GAMMA RADIATION IN NUCLEAR REACTORS
WITH GRAPHITE DELAY ELEMENT

The technique of estimating the density of the flux of associated gamma-emission in the effective and perspective nuclear reactors with graphite delay element has been introduced. It is shown that flux density of the associated gamma emission may be presented as the function of flux density of thermal neutrons. It is determined that calculation error is about 10% by the example of the reactor RBMK-1000.

UDC 533.93

Isakov Yu.I., Pushkarev A.I., Tarbokov V.A.
MEASURING THE COMPOSITION AND ENERGY
DISTRIBUTION OF A PULSED ION BEAM
BY THE TIME-OF-FLIGHT METHOD OF HIGH RESOLUTION

The compulsory checking technique of parameters of ion beam formed by a pulsed generator of powerful ion beams TEMP-4M in the mode of magnetic self-isolation accelerating voltage 200...250 kV, ion beam density 20...40 A/cm² has been proposed. The time-of-flight diagnostics on the basis of one fast-response sensor- Faraday cup with magnetic cut off was used. The technique allows determining the beam composition (ion type and degree of ionization), absolute values of ion current density and energy distribution for each ion type with an error not worse than ±10%.

UDC 533.9.082.5

Sorokin D.A., Lomaev M.I., Krivonogova K.Yu.
ELECTRON DENSITY AND TEMPERATURE IN DIFFUSIVE
DISCHARGE PLASMA FORMED AT HIGH OVERVOLTAGES
IN DENSE GASES

Average values of electron densities in diffusive discharge plasma in helium at pressures from 1 to 6 atm per pulse time have been determined by the Stark's broadening technique. The time dynamics of electron density in helium discharged plasma at atmospheric pressure was introduced. The peak value of electron density amounted to $\sim 5 \cdot 10^{15}$ cm⁻³ for the discharge plasma in helium at pressure 1 atm. In nitrogen discharge plasma an average electron temperature value which amounted to ~ 2.3 eV by a pulse time, as well as its dynamics were estimated by the technique based on collisional-radiation plasma model.

UDC 537.533.9

Grigoriev V.P., Vagin E.S., Ofitserov V.V.
MACROPARTICLE MODEL OF ELECTRON BEAM
CHARGE NEUTRALIZATION AT LOW PRESSURE
INJECTION INTO PLASMA

The task of modeling the process of electron beam transporting in a chamber filled up with low pressure plasma has been considered. The description of the numerical model developed in MatLab medium is introduced. The simulation results are given.

UDC 533.9

Grigoriev V.P., Ogorodnikov A.S.
MODELING THE DISTORTION OF THE EXTERNAL
MAGNETIC FIELD IN THE PACKAGE COMSOL
MULTIPHYSICS AT ELECTRON BEAM TRANSPORTING

Diamagnetic currents resulting in distortion of the external magnetic field may occur in inhomogeneous plasma. The magnetic field should be taken into account at development of the devices and units using magnetized plasma. In particular, this effect may influence considerably the processes connected with transporting the charged particle beams in plasma and gas media. Therefore, it is important to estimate this effect influence on distortion of the external magnetic field depending on plasma parameters. This task is reduced to solution of nonlinear equations system in partial derivatives and the system of computer mathematics COMSOL Multiphysics is applied for its solution.

UDC 536.46:531

Knyazeva A.G., Kryukova O.N., Bukrina N.V., Sorokova S.N.
THE PROBLEMS OF SIMULATING TECHNOLOGICAL
PROCESSES OF SURFACE MATERIAL TREATMENT
AND COATING USING HIGH-ENERGY SOURCES

The problems of modeling the irreversible processes resulting in formation of surface and coat properties have been analyzed by the examples of concrete models of technological processes and their stages. It is shown that the main problems of numerical simulation are connected with difference in scales of physicochemical and mechanical processes, their interrelation and absence of reliable experimental data on dependencies of the properties on composition.

UDC 531.22+536.413+544.032.2

Evstigneev N.K., Knyazeva A.G.
TWO-DIMENSIONAL MODEL OF SOLID-STATE
CHEMICAL CONVERSION IN A THIN PLATE IN CONDITIONS
OF UNIAXIAL SHEAR AND PURE SHIFT

The mathematical model of distribution of solid-phase chemical reaction in a plate in conditions of mechanical load in the form of uniaxial shear and pure shift has been proposed. The problem is solved in two-dimensional statement. The parametric investigation of the model was carried out. The stress and strain field evolution was analyzed. The influence of coherence of temperature fields, concentrations and stresses on conversion propagation was illustrated.

UDC 621.3.048.1

Boyarshtinov B.S., Khozhaynova G.I.
EXPERIMENTAL CHECK OF THE AGING THEORY
OF DIELECTRIC ISOLATION OF ZHURKOV-DMITREVSKIY

The results of the experiments on investigation of epoxy isolation life at different temperatures and after ionizing irradiation have been stated. The experimental data are explained from the position of thermo-fluctuation theory. The parameters of isolation destruction model including: volume and concentration of inhomogeneities, atom oscillation time in a carbon chain were obtained by the maximum likelihood method. Use of mathematical treatment in assumption of validity of thermo-fluctuation theory of Zhurkov-Dmitrevskiy allowed approximating the experimental ordered series with accuracy not worse than 4...10 %.

UDC 535-3:53.083

Sosnin E.A., Avdeev S.M., Erofeev M.V.,
Tsvetkov V.M., Pikulev A.A., Tarasenko V.F.
STUDYING ENERGY CHARACTERISTICS
OF KrCl-EXCILAMP DIELECTRIC BARRIER DISCHARGE

Power and radiation efficiency have been measured for verification of data on energy characteristics of KrCl-excilamp of dielectric barrier discharge by different methods and in different excitation conditions. It is shown that the values of radiation efficiency of KrCl-excilamp in the studied conditions do not exceed 7 %.

UDC 535.37:535.34:535.21:544.52

Bryantseva N.G., Sokolova I.V.,
Samsonova L.G., Khilya V.P., Garazd Ya.L.
PHOTOSTABILITY OF SUBSTITUTED COUMARINE SERIES
AT ACTION OF GAS-DISCHARGED EXCILAMP RADIATION

Photostability of five new substituted coumarins has been studied. Quantum yields of compound photodecay in their ethanol and aqueous-ethanol solutions were determined. The most stable compounds in aqueous-ethanol solutions are the 4'-methyl-3,4-cycloheptylpsoralen and 8-methoxypsoralen. All the studied compounds in ethanol solutions are rather photostable.

UDC 539.192:535.34:544.52

Timchenko O.V., Sokolova I.V., Vasilieva N.Yu.
QUANTUM CHEMICAL INVESTIGATION
OF SPECTRAL-LUMINESCENT PROPERTIES
OF STILBENE SUBSTITUENTS

Structure and spectral-luminescent properties of aryl-substituents of trans-stilbene (4-styryl-biphenyl, 4-styryl-terphenyl) have been studied by the methods of quantum chemistry (ChPDP/S, AM1,

RM3). Introduction of aryl substituents resulted in considerable increase of intensity of spectra and quantum yield of compound fluorescence that indicates the positive effect of the substituent. Spectral properties of the compounds in geometry of the main and excited S_1 state were calculated for explaining the radiative properties of the compounds and revealing the role of substituents. It is shown that radiating photoprocess acts the dominant part in the process of settlement of the excited molecules in S_1 state.

UDC 621.383.933

Gradoboev A.V., Skakov M.K.,
Politsinskiy E.V., Aubakirova D.M.
STABILITY OF LIGHT-EMITTING DIODES
OF IR-RANGE TO THE PULSE LASER BEAM ACTION

The results of investigation of stability of series light-emitting diodes of IR-range on the basis of epitaxial layers of GaAs, alloyed by Si, to the action of single pulses of laser beam with wave length of 1,06 μm and duration of 100 ns, 10 μs and 1 millisecond have been introduced. It is shown that power degradation of diode emission is conditioned by penetration of the contact metal-semiconductor; their stability depends to the large extent on direction of laser beam action. Several threshold values of laser beam power density: power density, lower which there is no diode degradation and upper which the diode degradation is observed, power density at which the complete penetration of the contact metal-semiconductor is observed and power density, at which the mechanical destruction of diodes by the surface crystal-crystal holder occurs, were determined. It was shown that the direction pattern of diode emission allows determining the threshold values of laser beam power density falling at an angle to diode optical axis. It was stated that diode nutrition regimen does not influence the set threshold densities of laser beam power.

UDC 621.3.08:621.3.001.4:621.3:658.562

Fedorov E.M., Goldshtein A.E.,
Svendrovskiy A.R., Redko V.V.
THE METER OF DIAMETER AND ECCENTRICITY
OF ELECTRIC CABLE ON THE BASIS
OF THE INDUCTIVELY OPTICAL METHOD

The inductively optical converter for controlling the diameter access and eccentricity of a single-core electric cable directly in the process of its production at manufacturing line has been described. The composition and technological implementation of the meter «Vector-1.01» on its basis was proposed.

UDC 534.5

Klimenko S.Yu., Savinov A.P.
MATHEMATICAL SIMULATION OF BEAT MODULATION
OCCURRING AT AUDIBLE SIGNAL SUPERPOSITION

The possibility of existence of all level modulation of beats determining the consequence of beat interval alternation with different duration occurring at pair sounding of monophonic signals has been revealed. It was stated that chain fractions are not simple one of the branches of mathematics allowing calculating approximately the function values but carry as well the deep physical sense. It was shown that the chain fraction parameters describe sufficiently with the desired accuracy the behavior of audible or electric signal in time as well as reflect its component structure, connected unambiguously with duration of the periods of the proper modulation levels of beat intervals occurring at superposition of two harmonic signals with random frequency ratios.